



PATENT SPECIFICATION

NO DRAWINGS

1.143.373

Date of Application and filing Complete Specification: 4 Aug., 1966.

No. 35075/66.

Application made in United States of America (No. 477,940) on 6 Aug., 1965.

Complete Specification Published: 19 Feb., 1969.

© Crown Copyright 1969.

Index at acceptance:—A2 B(J2, J3A2, J3A3, J3C, J3F¹, J3F2, J5)

Int. Cl.:—A 23 K 1/10

COMPLETE SPECIFICATION

Marbled Meat Animal Food and method of preparing same

5 We, QUAKER OATS COMPANY, a Corporation organized under the laws of the State of New Jersey, United States of America, of 617 West Main Street, Barrington, Illinois, United States of America, do hereby decalre the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to a meaty animal food having the appearance and texture similar to raw meat which is marbled throughout with fat.

15 An object of this invention is to provide a meaty pet food (i.e., one containing substantial amounts of meat or meat by-products) of the semi-moist type containing 20% to 50% by weight moisture and having the appearance of marbled meat. Another object of this invention is to provide a process by which a meaty pet food can be colored and formed to simulate different kinds and cuts of meat having varying degrees of marbling with or without an overlay having the appearance of fat. 25 A singularly important object of this invention is to provide a processed meaty pet food which ranks very high in palatability and acceptability to animals.

30 According to the present invention there is provided a meaty substantially solid semi-moist animal food resembling marbled meat containing 30 to 70 per cent by weight of meat or meat by-products and also containing 20 to 50 per cent by weight moisture comprising a red portion having the appearance of lean red meat and a white portion having the appearance of fat, said red portion containing 7.5 to 25% by weight sodium caseinate which is sufficient to cause tackiness at temperatures above 120°F., 15 to 30% by weight sugar, 2 to 10% by weight propylene glycol and 0.5 to 10% by weight starch, said white portion being randomly distributed in the red portion except for the fat-like overlay, if there is one, and said red and white portions being joined

to form an integral mass having substantially distinct interfaces between said portions.

The invention further provides a method for the manufacture of the substantially solid semi-moist animal food resembling marbled meat referred to above comprising the following steps: a) forming by a cooking-extrusion process a first sheet of unexpanded storage-stable semi-moist red portion having the appearance of lean red meat b) forming by a cooking-extrusion process a second sheet of unexpanded storage-stable semi-moist white portion having the appearance of fat, said cooking-extrusion process of steps (a) and (b) comprising the steps: 1) admixing comminuted portion ingredients said ingredients having been selected to provide a substantially solid, storage-stable nutritious animal food, 2) subjecting the resulting admixture to cooking conditions at a superatmospheric pressure sufficient to prevent substantial expansion of the resulting plastic mass in the extruder, and 3) extruding the resulting plastic mass through a die into the atmosphere; c) superimposing one of said sheets on the other; and d) forming superimposed sheets into a loaf-like mass, said forming being done in such a manner as to distribute randomly the white portion in the resulting mass, said forming taking place while the average temperature of said first and second sheets is between 120°F and 170°F.

The selection of specific nutritive ingredients to provide a substantially solid, storage-stable, nutritionally balanced pet food is well within the purview of one with ordinary skill in the art. Specific formulations are presented hereinafter, however, to illustrate several preferred embodiments of this invention. The adhesive for use in the present invention is sodium caseinate in an amount of 7.5 to 25% by weight of the red portion. This adhesive, which is nutritious and relatively stable at extruder-cooker conditions, is admixed with the other ingredients prior to the cooking and extrusion. However, other caseinate salts can

[I .]

be used together with sodium caseinate, such as those of calcium and potassium.

We have discovered that in the forming of the first and second sheets the inclusion of sodium caseinate adhesive in the semi-moist pet food ingredients of either portion prior to the cooking-extrusion step provides an extrudate which is tacky, or sticky, at temperatures above 120°F. (The minimum amount of caseinate required to provide stickiness depends on the specific ingredient formulation selected, and can be readily determined by adding different amounts to small trial batches.) We have also discovered that marbled meat-like loaves may be formed by merely bringing the first or red portion sheet in contact with the second or white portion sheet at temperatures above 120°F to provide a novel pet food product which is structurally stable and has no significant tackiness at room temperature and at temperatures normally contemplated during storage. While it is essential that the red portion contains the specified amount of sodium caseinate binder, it is more preferred that both the red and white portion contain sodium caseinate binder, in sufficient amount to provide stickiness at temperature above 120°F. We have also discovered, however, that the step of forming the superimposed extrudate sheets into a loaf-like mass must be carried out at an average temperature below 170°F or the resulting product will not resemble marbled meat. At temperatures above 170°F, the forming step results in a "bleeding" or infusion of the lean meat-like layer into the fat-like layer and vice versa, and the marbling appearance is substantially not achieved. The average temperature of the sheets may be measured, for example, by forming the sheets into a baseball-sized wad and inserting a thermometer into the wad.

While the dimensions of the first sheet referred to above are not critical, it may be a continuous or perforated sheet-like extrudate having a width from several inches to many feet, and preferably a thickness between 1/16 inch and 1/2 inch. The dimensions of the second sheet are not critical also, except, as indicated below, the second sheet preferably covers less than half the contacted surface of the first sheet. It also may be continuous, discontinuous or perforated and is usually incorporated into the finished product in an amount up to 45% by weight of the finished product. However, in the production of a beefsteak-like product, it is preferred that the second fat-like sheet be used in an amount of 15% to 25% by weight in the interior portions of the roll or cut, and it is usually preferred that an overlay of approximately 1/4 inch be laid down at the circumference of the roll. In the manufacture of a ham-like product, it is preferred that the second sheet be used in an amount of 5 to 10% by weight in the interior

or central portions of the roll and it is usually preferred that an overlay of approximately 1/4 inch be laid down on the circumference of the roll. Whenever a fat-like overlay is used, it is essential that the fat-like extrudate used in the overlay contain sodium caseinate adhesive in an amount sufficient to provide stickiness at temperatures above 120°F, and that the average temperature of the sheet be of 120° to 170°F, when being laid down.

Steak-like cuts can be prepared by slicing rolls of appropriate diameter; cuts resembling chops are prepared by slicing smaller diameter rolls or loaves which may have a relatively heavy fat-like overlay. The most preferred form of the product of this invention is obtained by slicing the loaves into cubes approximately 1/2 inch on an edge.

While a loaf can be formed around a prefabricated bone-like structure, the preferred products of this invention are "boneless". If a structure resembling bone is used, it must be either inert with respect to water pick-up, or it must have approximately the same water activity as the surrounding material.

In the practice of this invention it is essential that the fat-like extrudate be distributed randomly through the product except for the overlay referred to above. In the practice of this invention various methods of forming the superimposed sheets into a loaf-like mass may be employed, therefor, providing the method results in the substantially random distribution of the fat-like portion through the product. A certain degree of randomization is accomplished by forming a fat-like extrudate sheet of inconsistent and irregular thickness. Also, a certain degree of the randomization can be accomplished by superimposing the fat-like extrudate on the lean meat-like extrudate sheet in an irregular or random pattern. It is preferred that the fat-like extrudate sheet has a width less than half the width of the lean meat-like sheet and that the fat-like sheet is distributed in an irregular random fashion on the meat-like sheet. In a preferred embodiment, several narrow ribbons of fat-like extrudate are laid down on a wide sheet of red extrudate. It is preferred that the superimposed fat-like sheet or ribbons covers or cover much less than half of the contacted surface (normally the top surface) of the lean meat-like extrudate sheet. As indicated above, the fat-like sheet may be continuous, discontinuous and/or perforated. Also, the extrudates can be flattened or smeared into a sheet-like shape. Perforation-like irregularities can be achieved by extruding the fat-like portion in such a manner that large bubbles of steam are formed upon extrusion so that crater-like depressions result when the bubbles burst, or collapse. The more randomization that is accomplished when the fat-like sheet is superimposed on the lean meat-like sheet, the less randomization will be required when

the superimposed sheets are formed into a loaf-like mass. Also, the superimposing step and the loaf-forming step can be performed simultaneously.

5 The forming of the superimposed sheets into a loaf-like mass may be accomplished in accordance with this invention by several methods, such as, for example, a) permitting the superimposed sheets to form a random pile
10 beneath the end of a conveyer and compressing this tangled pile into a wad, b) catching the superimposed sheets in a forming means, such as a pan, while the first and second sheets are at the specified temperatures and thereafter
15 permitting the randomly distributed layers to integrate as a result of their own plasticity weight, and tackiness, and c) rolling the superimposed sheets into a roll.

20 In the preferred embodiment of this invention in which the superimposed sheets are rolled into a roll, little additional randomization may be necessary during the rolling step if a high degree of randomization was achieved during the step of superimposing the first and second sheets. However, it is generally preferred that when the superimposed sheets are formed into a roll, they be randomly laid down in a zone along the periphery which is at least twice the width of the red sheet. Hence, if a
25 4-inch wide ribbon or sheet of lean meat-like extrudate is being utilized, a minimum size loaf to be formed by the preferred rolling embodiment would be approximately 8 inches. On the other hand, for example, a continuous
30 roll may be formed by continuously laying a 3-inch wide lean meat-like sheet (on which the second fat-like sheet has been superimposed) across a 6 to 16 inch zone at the end of a continuously revolving roll or loaf while continuously withdrawing the resulting formed roll at such a rate as to keep the roll between 5 inches and 10 inches in diameter. Occasionally, in this preferred embodiment, superimposed sheets coming off a conveyer, for
35 example, may form loose random piles or wads behind a retreating revolving roll. These wads of extrudate are simply pushed into the end of the roll to incorporate them into the loaf or roll, and the resulting loaf end is then wrapped randomly by the oncoming superimposed sheets as before. If a wider diameter roll is formed, it can be kneaded or worked down to a loaf of desired size, provided the diameter reduction is carried out while the interior of the loaf is at a temperature between 120°F and 170°F. Generally speaking, the surface or "skin" of the roll will quickly fall below this temperature so that the "skin" is no longer tacky. Also, a plurality of smaller rolls can be formed into a "bundle" resembling a bundle of distinct major muscles by contacting the rolls at a temperature between 120°F. and 170°F., and applying sufficient pressure to convert them into an integral mass. The resulting bundle
65 can be overlaid with a fat-like layer, if desired,

in the manner described above. Slices of such multi-roll bundles can resemble the multi-muscle cuts such as, for example, round steak.

The randomized laying down of the superimposed sheets into a roll is done in such a way as to minimize the formation of air pockets in the rolled product. In the description of the process of this invention, therefore, the term rolling is intended to connote that the sheets are manipulated to cause contact in such a manner, e.g., with adequate pressure, to bring about adhesion with a minimum of air pockets and yet without substantial infusion of the white material into the red material.

Generally, the formulation of a pet food to provide storage stability is within the purview of one skilled in the art. In the practice of this invention a preferred formulation with respect to storage stability is one in which the water activity of the product is less than 0.90 and also contains an effective amount of mold inhibitor, such as sorbic acid or its salts. Water activity (a_w) as used herein is defined as follows:

$$a_w = \frac{f}{f_0}$$

where: f = fugacity of water vapor in the specified system
 f_0 = fugacity of pure water at the specified system temperature and 1 atmosphere total pressure.

Fugacity is a well-known physical-chemical term adequately defined in any appropriate text, such as *Physical Chemistry*, Prutton and Maron (1949) p. 318. As is apparent to those skilled in the art, water activity in the desired range is achieved by including appropriate quantities of soluble material such as sugars and glycols in the formulation.

We have found that formulations such as those listed in the numbered examples following using sugar in an amount of 15 to 30% by weight and propylene glycol in an amount of 2 to 10% by weight and sorbic acid or its salts in amounts from 0.06 to 0.3% by weight provide adequate storage stability for the products of this invention which contain moisture in an amount of 20% to 50% by weight based on the weight of the product.

The extrusion conditions in the method of this invention are such that the ingredients are cooked; preferably temperatures of 190° to 300°F. are used in the extruder with the pressure in the extruder being sufficient to prevent substantial expansion of the resulting plastic mass in the extruder. We have discovered that the use of starch-containing ingredients, such as cereals or cereal fractions such as starch, are essential to the practice of this invention in its broadest aspects. Therefore the red portion of the meat must contain from 0.5 to 10%

- by weight of starch. We have discovered that while meaty pet foods produced in accordance with this invention but which are devoid of starch have the necessary appearance and texture of marbled meat, they do not possess structural stability at elevated storage temperatures, i.e., above 120°F., e.g. 130°F to 135°F. Thus the inclusion of from 0.5 to 10% by weight of starch in the ingredients prior to cooking provides a product which is structurally stable to an eminently satisfactory degree under storage conditions at 135°F., provided temperatures in excess of 250°F are achieved in the extruders, during the manufacture of the product.
- As used herein, the term meaty indicates that a substantial portion of the ingredient list is made up of meat or meat by-products. The term meat is understood to apply to the flesh of cattle, swine, sheep, goats, horses, whale and other mammals, poultry and fish. The term meat by-products includes such constituents as are embraced by that term in the definitions of feed ingredients published by the Association of American Feed Control Officials Incorporated. The following examples set forth certain preferred formulations for pet foods which embody the principles of the present invention. As used herein, the term "parts" and the term "per cent" (or "%") refer to parts by weight and per cent by weight, respectively. Additionally, pet foods produced in accordance with the Examples normally have a moisture content between 28—30%, typically 29% by weight.
- EXAMPLE 1
- This example illustrates the manufacture of a beef-like marbled meaty pet food which does not melt at 135°F.
- The ingredients making up the "base", and making up the "marbling", were thoroughly mixed in separate blenders, in the proportion indicated in Table 1.

TABLE 1

	% Base	% Marbling	% Total
Beef Tripe	29.0000	42.50	32.3750
Sugar, Ready Mix Grade	26.5778	26.50	26.5584
Sodium Caseinate	15.0000	15.00	15.0000
Beef Trimmings, 40% Lean	13.5000	—	10.1250
Corn Starch	7.5000	7.50	7.5000
Propylene Glycol	4.5000	4.50	4.5000
Dicalcium Phosphate, Dihydrate	2.5000	2.50	2.5000
Salt, Iodized	1.2000	1.20	1.2000
Potassium Sorbate	0.1000	0.10	0.1000
Vitamin E Supplement (20,000 IU/pound)	0.0670	—	0.0503
Titanium Dioxide	—	0.20	0.0500
Riboflavin Supplement (4g/pound)	0.0270	—	0.0202
Vitamin A Supplement (30,000 IU/pound)	0.0178	—	0.0134
Irradiated Dried Yeast	0.0040	—	0.0030
FD & C Red #2	0.0027	—	0.0020
FD & C Yellow #6	0.0027	—	0.0020
Thiamine Mononitrate	0.0010	—	0.0007
	100.0000	100.0000	100.0000

The material referred to as "Base" in Table 1
 results in the first sheet referred to above as
 having the appearance of lean meat while the
 material referred to as "Marbling" in Table 1
 results in the second sheet described above as
 having the appearance of fat. The base ingredi-
 ents and the marbling ingredients were mixed
 separately and the resulting mixtures were
 charged to separate extruders at such a rate
 that the weight ratio of base extrudate to
 marbling extrudate was approximately 3:1.
 The conditions in the two extruders were sub-
 stantially identical. The extruders were steam
 jacketed, and the combination of friction and
 externally applied steam heat resulted in the
 achievement of peak temperatures in the extruders
 in the range of 260°F. to 275°F. The pressures
 utilized were adequate to prevent substantial
 expansion of the plastic mass within the extruder.
 Prior to expulsion from the extruder through the
 sheeting die, the compressed plastic mass was
 forced through a cooling section consisting of a
 pipe-like projection from the end of the extruder
 with the result that the temperature of the plastic
 mass at the die was substantially below the peak
 temperature range (260°—275°F. referred to
 above). This cooling step is desirable in that it
 minimized popping and spattering of the extrudate.
 The sheeting die utilized in the extrusion of the
 base provided an extrudate which was approximately
 3 inches wide, and generally between 1/16 to 1/2
 inch thick. The die utilized in the extrusion of the
 marbling sheet provided an extrudate sheet which
 was approximately 1 1/2 inches wide and likewise
 between 1/16 and 1/2 inch in thickness. Upon
 leaving the extruder, the extrudate develops large
 bubbles, e.g., from 1/2 to 1 1/4 inches in diameter
 which pop leaving an irregular surface on the
 unexpanded extrudate. The first sheet resulting
 from the extrusion of the base material was laid
 down on a moving conveyer belt and the second
 sheet resulting from the extrusion of the marbling
 ingredients was laid down on top of the first
 sheet on the conveyer belt. The second sheet was
 laid down, however, in an irregular and nonuniform
 pattern by rolling, skipping and balling portions
 of the second sheet prior to and/or upon its contact
 with the first sheet. The purpose of this is to
 randomize the distribution of the marbling

sheet on the lean meat-like first sheet in such
 a manner that only about a fourth of the surface
 of the first sheet was covered by the fat-like
 extrudate. The conveyer carried the superimposed
 sheets for sufficient length to permit the temperatures
 of the extrudates to drop to approximately 150°F.
 before the sheets were rolled into a roll. The roll
 was formed in such a manner as to provide the
 shape of a long loaf approximately 3 feet in length.
 As this loaf was continuously revolved around its
 longitudinal axis, the superimposed extrudate
 sheets coming off the conveyer were wound in
 random back and forth fashion until a loaf
 about eight inches in diameter was formed. Several
 loaves of equal size were prepared in this manner.
 The extrusion of the lean meat-like portion was
 then terminated. The extrusion of the marbling
 portion continued, however, and each of the 3 foot
 by 8 inch loaves previously produced were given an
 overlay of marbling portion between 1/4 and 3/4
 of an inch in thickness by replacing the loaf in the
 rolling device below the end of the conveyer and
 wrapping the fat-like extrudate around the
 continuously rotating loaf.

These loaves were permitted to cool to approximately
 room temperature, at which time they were cut
 into "steaks" approximately 3/4 of an inch in
 thickness. However, to facilitate production rates,
 the loaves may be cut immediately after forming,
 as desired. The "steaks" resembled marbled beef
 in that the red, lean meat portion was marbled
 throughout in a random fashion by the fat-like
 portion. "Steaks" produced in a substantially
 identical manner were further cut into cubes
 approximately 1/2 inch X 1/2 inch X 3/4 inch and
 fed to dogs in a feeding test in which fresh beef
 stew meat cut into cubes of substantially the
 same dimensions was used as a control. It was
 found that the product of this invention ranked
 equal to the fresh beef stew meat with respect
 to acceptability by the animals.

EXAMPLE 2

This example illustrates the production of a
 pet food resembling ham in appearance. A batch
 of ingredients, hereinafter referred to as base,
 and another batch of ingredients, hereinafter
 referred to as marbling, were thoroughly
 admixed in accordance with the formulation
 specified in Table 2.

TABLE 2

	% Base	% Marbling
Tripe	29.0	42.5
40% Beef	13.5	—
Sucrose	24.2	24.2
Sodium Caseinate	15.0	15.0
Food Grade Dicalcium Phosphate	2.5	2.5
Propylene Glycol	4.5	4.5
Salt	1.2	1.2
Sodium Sorbate	0.1	0.1
Corn Starch	10.0	10.0
FD & C Red #2	0.0015	0.0015
FD & C Yellow #6	0.0015	0.0015
	100.00	100.00

5 The thoroughly mixed ingredients were charged to separate extruders as in Example 1, except that the weight ratio of the quantity of base to marbling was approximately 19:1. The extrusion conditions, the manner of superimposing the extrudate sheets, the rolling of the extrudate sheets and the overlaying of the resulting roll with a layer of marbling extrudate were carried out as indicated in Example 1 except that the random superimposing of the fat-like sheet on the lean meat-like sheet covered only about 5% of the top surface of

the lean meat-like sheet. The loaf resulting from Example 2 was sliced into "steaks". 15 The sliced product was observed to closely resemble hamsteaks. The products of both Example 1 and Example 2 were subjected to stability tests in which temperatures of 135°F. were encountered, and it was found that the appearance and the structure of these products were substantially unchanged. 30

Generally speaking, we prefer the type of formulation specified in Table 3 for use in accordance with this invention. 35

TABLE 3

Preferred Formulation for the Red and White Portions

Meat and/or Meat By-products	30—70%
Sodium Caseinate	7.5—25%
Sugar	15—30%
Propylene Glycol	2—10%
Starch	0.5—10%
Supplements (vitamins, etc.)	1—5%
Permitted flavor and color ingredients	as desired

It is noted that the meaty marbling portion of the ingredients illustrated in Examples 1 and 2 above contain no red-meat ingredients. As used herein, the term "sugar" includes sucrose, glucose, corn-syrup sugars, and the like. We have found that the addition of from 0.2 to 0.4% titanium dioxide to the marbling ingredients assists in the achievement of a white fat-like appearance.

WHAT WE CLAIM IS:—

1. A meaty substantially solid semi-moist animal food resembling marbled meat containing 30 to 70 per cent by weight of meat or meat by-products and also containing 20 to 50 per cent by weight moisture comprising a red portion having the appearance of lean red meat and a white portion having the appearance of fat, said red portion containing 7.5 to 25% by weight sodium caseinate which is sufficient to cause tackiness at temperatures above 120°F., 15 to 30% by weight sugar, 2 to 10% by weight propylene glycol and 0.5 to 10% by weight starch, said white portion being randomly distributed in the red portion except for the fat-like overlay, if there is one, and said red and white portions being joined to form an integral mass having substantially distinct interfaces between said portions.

2. An animal food as in claim 1 in which said white portion contains sodium caseinate salt adhesive in an amount sufficient to provide stickiness at temperatures above 120°F.

3. An animal food as in claim 1 in which said red and white portions each comprise meat or meat by-products in an amount of 30 to 70% by weight, sodium caseinate in an amount of 7.5 to 25% by weight, sugar in an amount of 15 to 30% by weight, propylene glycol in an amount of 2 to 10% by weight and starch in an amount of 0.5 to 10% by weight.

4. A method for the manufacture of a substantially solid semi-moist animal food resembling marbled meat as claimed in claim 1 comprising the following steps:

a) forming by a cooking-extrusion process a first sheet of unexpanded storage-stable semi-moist red portion having the appearance of lean red meat,

b) forming by a cooking-extrusion process a second sheet of unexpanded storage-stable semi-moist white portion having the appearance of fat, said cooking extrusion process of steps (a) + (b) comprising the steps of:

1) admixing comminuted portion ingredi-

ents, said ingredients having been selected to provide a substantially solid storage-stable nutritious animal food,

2) subjecting the resulting admixture to cooking conditions at a superatmospheric pressure sufficient to prevent substantial expansion of the resulting plastic mass in the extruder, and

3) extruding the resulting plastic mass through a die into the atmosphere,

c) superimposing one of said sheets on the other, and

d) forming the resulting superimposed sheets into a loaf-like mass, said forming being done in such a manner as to distribute randomly the white portion in the resulting mass, said forming taking place while the average temperature of said first and second sheets is between 120°F and 170°F.

5. A method as in claim 4 in which said second sheet contains sodium caseinate salt adhesive in an amount sufficient to provide stickiness at temperatures above 120°F.

6. A method as in claim 4 in which said comminuted ingredients of each portion include sodium caseinate salt adhesive in an amount of 7½ — 25% by weight and starch in an amount of 0.5% — 10% by weight and in which said cooking conditions include heating said admixture to a temperature between 190°F and 300°F.

7. A method as in claim 4 in which said ingredients of each portion include meat or meat by-products in an amount of 30 to 70% by weight, sodium caseinate in an amount of 7.5 to 25% by weight, sugar in an amount of 15 to 30% by weight, propylene glycol in an amount of 2 to 10% by weight, starch in an amount of 0.5% to 10% by weight, and color modifying agents.

8. A method as in claim 4 in which said forming step includes rolling the superimposed sheets into a roll.

9. A meaty substantially solid semi-moist animal food resembling marbled meat substantially as herein described.

10. A method for the manufacture of a substantially solid semi-moist animal food resembling marbled meat substantially as herein described.

STEVENS, LANGNER, PARRY
& ROLLINSON,
Chartered Patent Agents,
Agents for the Applicants.